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PlastiPOPd Web Interactive: Software to investigate the life history plasticity in Bald Eagles in the Northeast United States

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Overview of the software application

PlastiPOPd is an interactive software that is used to explore the relative distance between wildlife populations and extinction given various disease scenarios. Although this app may be used with any 3-stage population matrix model, the software is currently programmed to assess the extinction risk of lead-altered conditions of bald eagles in the Northeast United States.

This app shows the results of the integration of lead toxicosis data in breeding adult bald eagles from seven Northeastern United States with current population dynamics (“CounterPOPd software application; <https://doi.org/10.7298/0v1k-wq39>). In particular, the PlastiPOPd interactive application collapses three scenarios of the eagle life cycle into summary metrics and plots those metrics as 3-D coordinates in a 3-D Euclidean plane. Comparative scenarios include (1) current (leaded) scenarios (“N”) in the Northeast United States, (2) a hypothetical scenario with the removal of acute lead toxicosis cases (“A”), and (3) a hypothetical scenario with the removal of acute and chronic lead toxicosis cases (“C”). Also on the 3-D plane is the threshold between population viability and inviability (e.g. extinction), so users may compare the proximity of each scenario to intrinsic inviability. Variations of the PlastiPOPd app allow for the additional investigation when density dependence is considered.

Interactive Software User Tutorial

Preparing and running the software for female and male bald eagles

A. Running the app (as is) for female bald eagles:

This version of the app corresponds to bald eagles in the Northeast, US from 1990-2018.

Step 1: Download and save the “Full Recovery” folder on your computer.

Step 2: Open the “Females” subfolder.

Step 3: Inside that subfolder, you will find two R files and one .txt file.

Step 4: To run PlastiPOPd as is, open the “FemalePlastiPOPd.R” file in R Studio.

Step 5: Install five packages: “shinyBS”, “shiny”, “rgl”, “plot3D”, and “rmarkdown”. To install a package, type `install.packages("shinyBS")` into your console and run the line.

Repeat with the other packages.

Step 6: Hit “Run all”. The software will automatically call upon the pre-saved “Viable.txt” file to generate the interactive software interface.

B. Running the app (as is) for male bald eagles:

This version of the app corresponds to bald eagles in the Northeast, US from 1990-2018.

Step 1: Download and save the “Full Recovery” folder on your computer.

Step 2: Open the “Males” subfolder.

Step 3: Inside that subfolder, you will find two R files and one .txt file.

Step 4: To run PlastiPOPd as is, open the “MalePlastiPOPd.R” file in R Studio.

Step 5: Install five packages: “shinyBS”, “shiny”, “rgl”, “plot3D”, and “rmarkdown”. To install a package, type `install.packages("shinyBS")` into your console and run the line.

Repeat with the other packages.

Step 6: Hit “Run all”. The software will automatically call upon the pre-saved “Viable.txt” file to generate the interactive software interface.

C. Modifying and running the app with different bald eagle parameters:

You may modify the PlastiPOPd app for use with different parameter values. The CounterPOPd software (<https://doi.org/10.7298/0v1k-wq39>) may be used to attain different vital rates given differing time series data.

Step 1: Download and save the “Full Recovery” folder on your computer, then open the “Males” or “Females” subfolder.

Step 2: In R, open the “Generating Dataset for PlastiPOPd.R”

Step 3: Change your directory to the location in Step 1.

Step 4: Alter the “F” input to reflect your desired fertility.

Step 5: Hit “Run all.” A new version of the “Viable.txt” file will automatically appear.

Step 6: Close R.

Step 7: In R Studio, open the “FemalePlastiPOPd.R” (or) “MalePlastiPOPd.R” app.

Step 8: Install five packages: “shinyBS”, “shiny”, “rgl”, “plot3D”, and “rmarkdown”. To install a package, type `install.packages("shinyBS")` into your console and run the line.

Repeat with the other packages.

Step 9: Modify the vital rates according to the CounterPOPd output. Modifiable vital rates include:

- Median Annual SI Survival in the NE (NEp1median, line 85)
- Median Annual SII Survival in the NE (NEp2median, line 86)
- Median Annual SIII Survival in the NE (NEp3median, line 87)
- Median Annual SI Survival in A (Ap1median, line 88)
- Median Annual SII Survival in A (Ap2median, line 89)
- Median Annual SIII Survival in A (Ap3median, line 90)
- Median Annual SI Survival in C (Chp1median, line 91)
- Median Annual SII Survival in C (Chp2median, line 92)
- Median Annual SIII Survival in C (Chp3median, line 93)
- Minimum Annual SI Survival in the NE (NEp1min, line 116)
- Minimum Annual SII Survival in the NE (Nep2min, line 117)
- Minimum Annual SIII Survival in the NE (Nep3min, line 118)
- Minimum Annual SI Survival in A (Ap1min, line 119)
- Minimum Annual SII Survival in A (Ap2min, line 120)
- Minimum Annual SIII Survival in A (Ap3min, line 121)
- Minimum Annual SI Survival in C (Chp1min, line 122)
- Minimum Annual SII Survival in C (Chp2min, line 123)
- Minimum Annual SIII Survival in C (Chp3min, line 124)
- Maximum Annual SI Survival in the NE (NEp1max, line 126)
- Maximum Annual SII Survival in the NE (Nep2max, line 127)
- Maximum Annual SIII Survival in the NE (Nep3max, line 128)
- Maximum Annual SI Survival in A (Ap1max, line 129)
- Maximum Annual SII Survival in A (Ap2max, line 130)
- Maximum Annual SIII Survival in A (Ap3max, line 131)
- Maximum Annual SI Survival in C (Chp1max, line 132)
- Maximum Annual SII Survival in C (Chp2max, line 133)
- Maximum Annual SIII Survival in C (Chp3max, line 134)

Step 10: Hit “Run all”, and begin interacting with the app.

D. Using a variation of the app with density dependence considerations:

You may modify the PlastiPOPd app for use with density dependent parameter values. The DensityPOPd software (<https://doi.org/10.7298/6yb8-5c25>) may be used to attain parameter values of early and late bald eagle recovery. In context, “early recovery” corresponds to the period of bald eagle recovery in the Northeast United States from 1990-2006, while “late recovery” corresponds to the period of bald eagle recovery in the Northeast United States from 2002-2018. You may compare remaining plasticity between these differing time windows, between sexes, or both.

Step 1: Download and save the “Early Recovery” (or) “Late Recovery” folder on your computer.

Step 2: Open the “Females” (or) “Males” subfolder.

Step 3: Inside that subfolder, you will find two R files and one .txt file.

Step 4: To run PlastiPOPd as is, open the “FemalePlastiPOPd.R” (or) “MalePlastiPOPd.R” file in R Studio

Step 5: Install five packages: “shinyBS”, “shiny”, “rgl”, “plot3D”, and “rmarkdown”. To install a package, type `install.packages("shinyBS")` into your console and run the line. Repeat with the other packages.

Step 6: Hit “Run all”. The software will automatically call upon the pre-saved “Viable.txt” file to generate the interactive software interface.

Step 7: To modify parameter values, follow the instructions in D.

Technical details

The PlastiPOPd app was written under R Studio Version 3.5.3 (2019-03-11) – “Great Truth” © 2019 RStudio, Inc. requires six R Shiny packages: “shinyBS”, “shiny”, “rgl”, “plot3D”, and “rmarkdown”. The “Generating Dataset for PlastiPOPd.R” was written under R Version 3.5.3.

Financial Support

This study was funded in part by the Morris Animal Foundation under Grant # D18ZO-103. This software has not been reviewed nor endorsed by the Foundation, and the views expressed in this software do not necessarily reflect the views of the Foundation, its officers, directors, affiliates or agents.

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Suggested Citation for this Software:

Hanley, B., Dhondt, A., Bunting, E., Pokras, M., Hynes, K., Forzán, M., & Schuler, K. 2019.

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